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Freshwater Mussels of the Sangamon River

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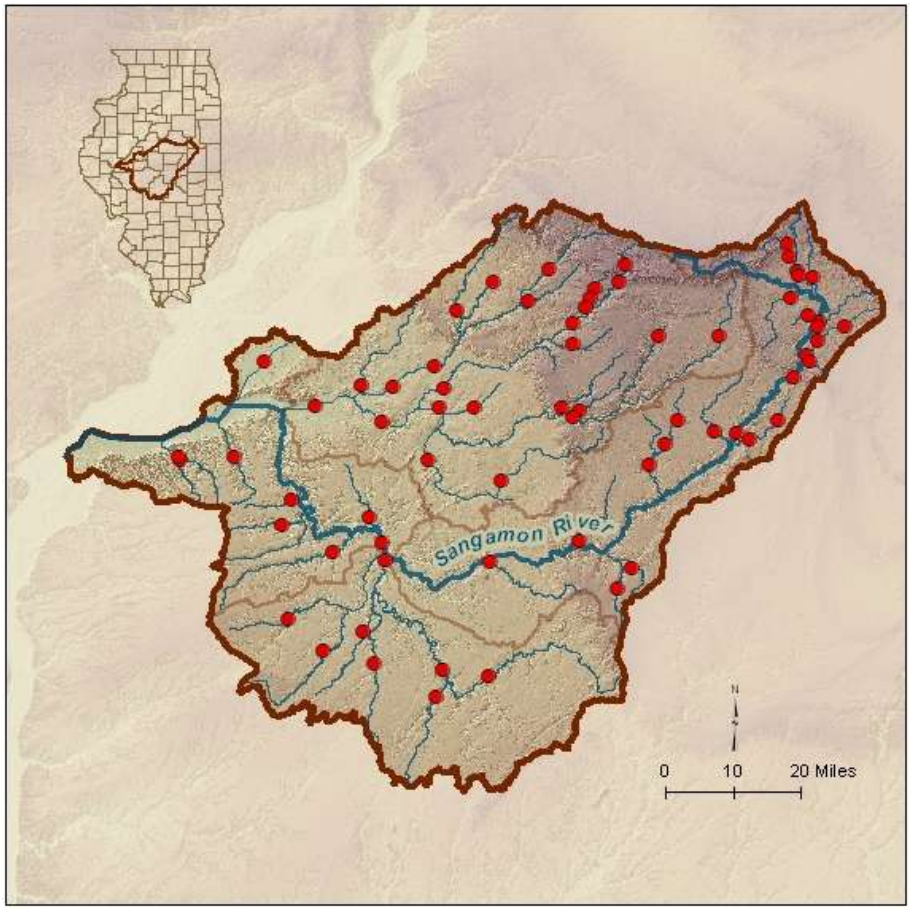

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Preface

While broad geographic information is available on the distribution and abundance of mussels in Illinois, systematically collected mussel-community data sets required to integrate mussels into aquatic community assessments do not exist. In 2009, a project funded by a US Fish and Wildlife Service State Wildlife Grant was undertaken to survey and assess the freshwater mussel populations at wadeable sites from 33 stream basins in conjunction with the Illinois Department of Natural Resources (IDNR)/Illinois Environmental Protection Agency (IEPA) basin surveys. Inclusion of mussels into these basin surveys contributes to the comprehensive basin monitoring programs that include water and sediment chemistry, instream habitat, macroinvertebrate, and fish, which reflect a broad spectrum of abiotic and biotic stream resources. These mussel surveys will provide reliable and repeatable techniques for assessing the freshwater mussel community in sampled streams. These surveys also provide data for future monitoring of freshwater mussel populations on a local, regional, and watershed basis.

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Introduction

Freshwater mussel populations have been declining for decades and are among the most seriously impacted aquatic animals worldwide (Bogan 1993, Williams et al. 1993). It is estimated that nearly 70% of the approximately 300 North American mussel taxa are extinct, federally-listed as endangered or threatened, or in need of conservation status (Williams et al. 1993, Strayer et al. 2004). In Illinois, 25 of the 62 extant species (44%) are listed as threatened or endangered (Illinois Endangered Species Protection Board 2011) and an additional 5 species are considered species in greatest need of conservation (IDNR 2005). This report summarizes the mussel survey conducted in the Sangamon River basin from 2009 to 2011 at IEPA/IDNR basin survey sites.

The Sangamon River basin drains 14,035 km^2 (5419 mi^2) in central Illinois and has the largest watershed of any Illinois River tributary (Page et al. 1992). The river rises in McLean County and flows primarily southwesterly until it converges with the Illinois River in Cass County (Figure 1). The Sangamon River basin is comprised of three main sections: the Upper Sangamon (including McLean, Champaign, Piatt, and Macon Counties), Salt Creek (including McLean, Dewitt, Logan, Macon, Mason, and Menard Counties), and the South Fork and Lower Sangamon (including Macon, Christian, Sangamon, Menard, and Cass Counties). Nearly all of the Sangamon River and tributaries flow through the Grand Prairie natural division, although a small portion of the river and tributaries flow through the Illinois River Bottomlands Division and Sand Areas Division near its confluence with the Illinois River (Schwegman 1973).

Land-use and Instream Habitat

The Upper Sangamon has a relatively high proportion of stream communities that are considered high-quality natural communities compared to other watersheds in Illinois (Bertrand et al. 1996, IDNR 2000), although stream degradation still exists. Over 90% of the Upper Sangamon is intensively farmed in row crop agriculture, and impacts from on-going sand and gravel mining and historical coal mining near Decatur are also present (IDNR 2000). Lake Decatur impounds the Upper Sangamon River in the heart of Macon County, and water quality in the river downstream of Decatur is classified as “fair”, due to pollution from excessive nitrates, poor waste water treatment, historical coal mining, and legacy industrial chemicals (IDNR 2000, IEPA 2010). Several large impoundments are located in the Lower Sangamon and South Fork, including Sanchris Lake, Lake Springfield, and Lake Taylorville. In addition to water quality issues related to impoundments, the South Fork Sangamon and part of the lower Sangamon flows through Springfield and degradation related to urbanization exists (Figure 4; IDNR 2003). Much of the South Fork Sangamon River, however, maintains natural meanders and has a wide riparian zone, and these characteristics are unique to central Illinois. The Salt Creek drainage, similar to the Upper Sangamon, has several miles of streams that are

considered highly valued aquatic resources (Bertrand et al. 1996; Figure 5). Nevertheless, this drainage is impacted by similar stressors, including row crop agriculture and the impoundment of Clinton Lake. Much of the lower section of Salt Creek and the Sangamon River downstream of the confluence with Salt Creek has been leveed and channelized (Figure 6).

Substrates and habitats throughout the Sangamon basin are highly variable. The Upper Sangamon is dominated by consolidated sand and gravel, with silt, and minimal claypan. The Lower Sangamon is dominated by silt, with significant sand and claypan. Substrates in the Salt Creek drainage are primarily coarse sand and gravel, with silt, claypan, and boulder or cobble existing in small amounts in many streams.

Methods

During the 2009-2011 survey, freshwater mussel data were collected at 67 sites: 25 in the Upper Sangamon drainage, 26 in the Salt Creek drainage, and 16 in the Lower Sangamon and South Fork drainage (Figure 1; Table 1). Locations of sampling sites are listed in Table 1 along with information regarding IDNR/IEPA sampling at the site. In most cases, mussel survey locations were the same as IDNR/IEPA site. At four sites, mussel data were collected on more than one occasion to fulfill sampling objectives for other analyses, and these sites are noted on Table 1.

Live mussels and shells were collected at each sample site to assess past and current freshwater mussel occurrences. Live mussels were surveyed by hand grabbing and visual detection (e.g., trails, siphons, exposed shell) when water conditions permitted. Efforts were made to cover all available habitat types present at a site including riffles, pools, slack water, and areas of differing substrates. A four-hour timed search method was implemented at most sites, and a 16-hour timed search method was implemented at four sites to fulfill sampling objectives for another project (Table 1). Live mussels were held in the stream until processing.

Following the timed search, all live mussels and shells were identified to species and recorded (Table 2). For each live individual, shell length (mm), gender, and an estimate of the number of growth rings were recorded. Shell material was classified as recent dead (periostracum present, nacre pearly, and soft tissue may be present) or relict (periostracum eroded, nacre faded, shell chalky) based on condition of the best shell found. A species was considered extant at a site if it was represented by live or recently dead shell material (Szafoni 2001). The nomenclature employed in this report follows Turgeon et al. (1998) except for recent taxonomic changes to the gender ending of lilliput (*Toxolasma parvum*), which follows Williams et al. (2008; Appendix 1). Voucher specimens were retained and deposited in the Illinois Natural History Survey Mollusk Collection. All non-vouchered live mussels were returned to the stream reach where they were collected.

Parameters recorded included extant and total species richness, presence of rare or listed species, and individuals collected, expressed as catch-per-unit-effort (CPUE; Table 2). A population indicated recent recruitment if individuals with lengths less than 30 mm or with 3 or fewer growth rings were observed. Finally, mussel resources were classified as Unique, Highly Valued, Moderate, Limited, or Restricted (Table 2) based on the above parameters (Table 3) and following criteria outlined in Table 4 (Szafoni 2001).

Results

Species Richness

A total of 35 species of freshwater mussels were observed in the Sangamon River basin, 28 of which were live (Table 2). Across all sites, the number of live species and extant species (live + dead) collected ranged from 0 to 16 and the total number of species collected (live + dead + relict) ranged from 0 to 19. The Upper Sangamon River drainage species richness ranged from 0 to 16 live and extant species and 0 to 17 total species. The Salt Creek drainage species richness ranged from 0 to 14 live species, 0 to 16 extant species, and 4 to 19 total species. The Lower Sangamon River and South Fork drainage species richness ranged from 0 to 10 live species, and there were 0 to 12 extant species and total species. In the Upper Sangamon River sites, the plain pocketbook (*Lampsilis cardium*) was the most widespread species, collected at 12 of 25 sites (48%; Figure 2a). The fatmucket (*Lampsilis siliquoidea*), Wabash pigtoe (*Fusconaia flava*), and white heelsplitter (*Lasmigona complanata*) were encountered at 37% and 41% of Upper Sangamon River sites (Figure 2a). In Salt Creek sites, the plain pocketbook was the most widespread species across sites, collected at 23 of 26 sites (89%; Figure 2b). Other widespread species were the white heelsplitter (59%), Wabash pigtoe, and fatmucket (52%; Figure 2b). In the Lower Sangamon River and South Fork drainage, the most widespread species included the white heelsplitter, fragile papershell (*Leptodea fragilis*), and giant floater (*Pyganodon grandis*), which occupied 4 of 16 sites (25%; Figure 2c). The pistolgrip (*Tritogonia verrucosa*) occurred at 19% of sites.

Abundance and Recruitment

A total of 4307 individuals were collected across 67 sites, and the number of live individuals collected at a site with live mussels detected ranged from 1 to 426. The range of live individuals collected ranged from 1 to 401 at Upper Sangamon River sites, from 3 to 426 at Salt Creek sites, and from 5 to 56 at Lower Sangamon River and South Fork sites. A total of 324 collector-hours were spent sampling, with an average of 13 mussels collected per hour. The most commonly collected species across all sites was the Wabash pigtoe, which comprised 20% of all individuals collected (n=861). The fatmucket was the most commonly collected species in the Upper Sangamon River drainage (n=475), the plain pocketbook was the most commonly collected

species in the Salt Creek drainage (n=361), and the giant floater was the most commonly collected species in the Lower Sangamon River and South Fork drainage (n=58; Table 2).

Recruitment for each species was determined by the presence of individuals less than 30 mm or with 3 or fewer growth rings. Smaller (i.e. younger) mussels are harder to locate by hand grab methods and large sample sizes can be needed to accurately assess population reproduction. However, a small sample size can provide evidence of recruitment if it includes individuals that are small or possess few growth rings. Alternatively, a sample consisting of very large (for the species) individuals with numerous growth rings may suggest a senescent population.

Recruitment observed at individual sites ranged from none to high across the basin; 54% of sites where mussels were collected had no observed recruitment (28 of 52 sites; Figure 3). We observed recruitment in over 50% of species collected at three sites in the Upper Sangamon River drainage (sites 4, 8, and 22; Drummer, Owl, and Big Creeks). One site in the Salt Creek drainage (site 46; Middle Fork Sugar Creek) and two sites in the Lower Sangamon River and South Fork drainage (sites 57 and 59; Sugar Creek and Sangamon River) had observed recruitment of over 50% of species.

Mussel Community Classification

Based on the data collected in the 2009-2011 basin survey, 77% of the sites where mussels were collected in the Sangamon River basin are classified as Moderate, Highly Valued, or Unique mussel resources under the current MCI classification system (Table 4, Figure 3). Site 7 (Sangamon River, both sampling events) and site 45 (Timber Creek) stand out as Unique Resources due to the presence of intolerant species, the number of mussels collected, and the species richness of the site. Seven sites in the Upper Sangamon River drainage, including Drummer Creek (site 4), West Branch Drummer Creek (site 3), Big Ditch (site 11), Friends Creek (site 21), Lone Tree Creek (site 1), Dickerson Slough (site 6), and Friends Creek Ditch (site 19), were classified as Highly Valued mussel resources. Five sites in the Salt Creek drainage, including Salt Creek (sites 27 and 29), Middle Fork Sugar Creek (site 46), and Timber Creek (site 45), were also Highly Valued mussel resources. One site in the Lower Sangamon River and South Fork drainage, the Sangamon River (site 59), was classified as a Highly Valued mussel resource (Figure 3).

Noteworthy Finds

This survey collected 28 live species and 35 total species; approximately 48 species were known historically from the Sangamon River basin. Thirteen species with historical records from the Sangamon River basin that were not collected during this survey include the flat floater (*Anodonta suborbiculata*), purple wartyback (*Cyclonaias tuberculata*), butterfly (*Ellipsaria lineolata*), snuffbox (*Epioblasma triquetra*), Higgins eye (*Lampsilis higginsii*), scaleshell

(*Leptodea leptodon*), washboard (*Megalonaias nervosa*), hickorynut (*Obovaria olivaria*), wartyback (*Quadrula nodulata*), winged mapleleaf (*Quadrula fragosa*), salamander mussel (*Simpsonaias ambigua*), rainbow (*Villosa iris*), and little spectaclecase (*Villosa lienosa*).

Five species, mucket (*Actinonaias ligamentina*), spike (*Elliptio dilatata*; state-threatened), black sandshell (*Ligumia recta*; state-threatened), sheepnose (*Plethobasus cyphyus*; federally-endangered), pyramid pigtoe (*Pleurobema rubrum*; state-endangered), and ellipse (*Venustaconcha ellipsiformis*) were only represented in these surveys by relict shell. Our survey also found relatively few or no live occurrences for the elktoe (*Alasmidonta marginata*), paper pondshell (*Utterbackia imbecillis*), monkeyface (*Quadrula metanevra*), fluted shell (*Lasmigona costata*), and fawnsfoot (*Truncilla donaciformis*), although dead and relict shell records were found at multiple sites.

Only one state-listed species, the slippershell (*Alasmidonta viridis*), was found alive in our survey (Table 2). The slippershell was recorded alive at eight sites and was represented by 34 individuals; five sites were located in the Upper Sangamon River drainage (n=26) and three sites were located in the Salt Creek drainage (n=8).

Discussion

Richness, Abundance and Recruitment

The Sangamon River supported over 40 species of freshwater mussels historically, yet current extant species richness (i.e., live mussels and dead shell) was only 29 species (Table 2d). Nonetheless, some sites maintain diverse and valued mussel resources; 16 extant species were found at two sites in the Upper Sangamon River drainage (site 7: Sangamon River at Fisher and site 21: Friends Creek), 14 extant species were found at one site in the Salt Creek drainage (site 29, Salt Creek), and 12 extant species were found at one site in the Lower Sangamon River drainage (site 54: South Fork Sangamon River). The South Fork and Lower Sangamon River had fewer individuals and species than either the Salt Fork or Upper Sangamon River, but the South Fork Sangamon River (e.g., site 54) appears to support a relatively high diversity of mussels for this portion of the basin. This is consistent with the findings by Schanzle and Cummings (1991) and M. R. Matteson in 1956-1960, who reported reductions in richness and abundance in the reach between Decatur and Springfield. Explanations for lower species richness in the lower portion of the basin include impairments such as sedimentation, siltation, and chemical pollutants. Agricultural, industrial and municipal sources have introduced various pollutants, including polychlorinated biphenyls and nitrates (IDNR 2000, IEPA 2010). In addition, water depths greater than 1 m in much of the lower portion of the basin hindered our ability to document mussels in this section of the river, and few mainstem sites downstream of Lake Decatur were sampled in the 2009-2011 survey (Figure 7).

We collected greater than 100 individuals at seven sites in the Upper Sangamon River drainage and six sites in the Salt Creek drainage (Table 2). While some of these sites were highly skewed towards one species (e.g., n=401 at site 1, with 329 Wabash pigtoes), the species richness at these sites ranged between 5 and 16 live species, indicating fairly intact, abundant, and diverse communities. Interestingly, the drainages within the Sangamon River basin each had a different suite of species that dominated the sample; it appears that across the three drainages, there are abundant, diverse, and unique assemblages of freshwater mussels (Table 2).

Noteworthy Finds

The Sangamon River has been the subject of several mussel studies and reports, and these studies have been concisely summarized by Schanzle and Cummings (1991). Although only 5 of their 57 sites overlap with sampling sites from this study (sites 7, 40, 43, 51, 54, and 57), their survey provides a valuable reference point for mussels in the Sangamon River. A comparison of our results with the 1991 study is found in Table 2d, and our live species collections were fairly similar to the 1991 survey. Overall species composition rank (proportion of total) varied between surveys, and this variation could be due to differences in sampling location, sampling conditions (e.g., temperature or substrate), a shift in host fish community, or change in the mussel community. Additionally, their publication provided details for each mussel species recorded historically from the Sangamon River watershed. Of particular note is the discussion of potentially spurious records from a collector named Elihu Hall; Hall's specimens bear only the notation of "Sangamon River" or "Athens, Illinois", thus exact location information cannot be ascertained (for additional information on Hall's collections see Schwegman 2012). The butterfly, Higgins eye, purple wartyback, scaleshell, snuffbox, and winged mapleleaf fall into this category and have no other records from the Sangamon River basin. These species are almost certainly extirpated from the Sangamon River basin, and they may never have occurred in the basin at all.

Based on our survey and past surveys (as summarized in Schanzle and Cummings 1991), we have identified several other species that are likely extirpated from the Sangamon River basin: ebonyshell, hickorynut, little spectaclecase, mucket, pyramid pigtoe, rainbow, salamander mussel, sheepnose, and spike. Many of these species have not been collected alive or via shell in several decades (INHS Collections database). These species are rare throughout their range in Illinois, were listed as likely extirpated in the Sangamon River by Schanzle and Cummings (1991), and are federally- or state-endangered (with the exception of the hickorynut and mucket). Only one record exists in the Sangamon River basin for the hickorynut, so it was likely never a large portion of the fauna; muckets, while common in other basins, are no longer present in the Sangamon River. Shells of the salamander mussel have been collected a few times in the Sangamon basin since the 1990s (INHS Mollusk Collection) and this thin-shelled

species may persist in specific habitats where its host, the mudpuppy (*Necturus maculosus*), is extant.

Other species not located alive in our survey known historically from the watershed include the ellipse, paper pondshell, flat floater, and washboard. The paper pondshell and flat floater occupy habitats that were not encountered during our surveys (sluggish pools and backwaters) and are widespread and stable elsewhere throughout their range (Cummings and Mayer 1992). Ellipse, a species in greatest need of conservation (IDNR 2005) in Illinois, has not been found alive since the surveys by Schanzle and Cummings (1991) and is either scarce or extirpated in the Sangamon River basin. The washboard was last collected alive in the South Fork Sangamon River in 1997 and is also either scarce or extirpated (INHS Mollusk Collection). It is possible that this species could still exist in this region; however, water levels (> 1 m) made sampling in the lower portion of the Sangamon River infeasible with our methods at several sites. Different methods of sampling, e.g. SCUBA or brail sampling, would need to be conducted to determine if this species exists in this drainage.

Several species were only represented by a few live records, and these include the elktoe (*Alasmidonta marginata*), flutedshell (*Lasmigona costata*), creek heelsplitter (*Lasmigona compressa*), and monkeyface (*Quadrula metanevra*). These species were also listed as rare in Schanzle and Cummings' survey (1991) and remain rare in the Sangamon River basin at this time. Our survey detected 35 individuals of the state-threatened slippershell across nine sites in the Upper Sangamon and Salt Fork Sangamon drainages. Based on our survey and previous surveys, this species may have a stable or increasing population in the Sangamon River basin.

Summary

Our surveys documented the existence of 35 of the approximately 48 species reported historically from the Sangamon River basin. Additionally, our surveys found that 29 of these species were represented by live individuals or dead shell. Although many species of freshwater mussels still inhabit the Sangamon River, this basin is experiencing ongoing species decline and has almost certainly lost some species permanently. Precise factors causing the decline in mussel fauna are not known. Some commonly cited problems occurring throughout this basin include industrial and agricultural pollution, habitat loss, and sedimentation (Richter et al. 1997, IEPA 2010). The Sangamon River drainage has undergone significant modification in the forms of channelization, municipal and industrial pollution, and intensive row-crop agriculture (Schanzle and Cummings 1991, Page et al. 1992, IDNR 2000). However, the upper portions of the Sangamon and Salt Creek are capable of supporting biologically diverse and abundant mussel populations and should be protected from further disturbance.

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Table 1. 2009-2011 Sangamon River Intensive Basin Survey. MU-mussel sampling, BE-boat electrofishing, ES-electric fish seine, FF-fish flesh contaminate, H-habitat, M-macroinvertebrate, S-sediment, and W-water chemistry. [a]multiple mussel surveys, [b]16-hour sample, *estimated.

Site number	IEPA Code	Stream	Types of Samples	County	Location	Watershed area (km^2)
Upper Sangamon drainage						
1	EZW-01	Lone Tree Creek	MU,W,S,H,ES,M	Champaign	1.5 mi E Foosland, Co. Rd. 300E bridge	130.43
2	EYA-02	West Branch Drummer Creek	MU	Ford	2.1 mi WNW Gibson City, Co. Rd. 550N bridge	27.27
3	EYA-01	West Branch Drummer Creek	MU	Ford	1.5 mi SW Gibson City, Co. Rd. 300E bridge	27.27
4	~ EY-04	Drummer Creek	MU	Ford	3 mi S Gibson City, Co. Rd. 400E bridge	149.74
5	EY-01	Drummer Creek	MU,W,S,H,ES,M	Ford	3.25 Mi S Gibson City On Co Rd 075N	146.26
6	EZZH-02	Dickerson Slough	MU	Ford	4.5 mi SE Gibson City, Co. Rd. 50N bridge	57.42
7[a]	E-29	Sangamon River	MU,W,S,H,BE,M	Champaign	1 mi E Fisher, Rt. 136 bridge	616.45
8	EZV-01	Owl Creek	MU	Champaign	0.5 mi NW Fisher, Co. Rd. 3100N bridge	21.94
9	EZZF-01	Wildcat Slough	MU	Champaign	1 mi SE Fisher, Co. Rd. 700E bridge	48.96
10	EZU-03	Big Ditch	MU	Champaign	5.3 mi NW Thomasboro, Co. Rd. 1100E bridge	75.0*
11	EZU-02	Big Ditch	MU	Champaign	3.5 mi SE Fisher, Co. Rd. 700E bridge	100.0*
12	EZU-01	Big Ditch	MU,W,S,H,ES,M	Champaign	3.5 mi NNE Mahomet, Co. Rd. 2500N bridge	131.04
13	EZZQ-01	Phillippe Creek	MU	Champaign	3 mi N Mahomet, Co. Rd. 600E bridge	20.0*
14	E-19	Sangamon River	MU,W	Champaign	Rt 150 Br At Mahomet	933.94
15	E-18	Sangamon River	MU,W,S,H,BE,M	Piatt	0.5 Mi W Monticello	1428.87
16	EX-01	Goose Creek	MU,W,S,H,ES,M	Piatt	3.5 mi SE DeLand, Co. Rd. 1950N bridge	131.73
17	EW-02	Camp Creek	MU	Champaign	1 mi SW Seymour, Co. Rd. 1500N bridge	52.45
18	EW-01	Camp Creek	MU,W,S,H,ES,M	Piatt	3.5 mi NE Monticello, Co. Rd. 1225E bridge	119.06
19	EVB-01	Friends Creek Ditch	MU	Piatt	2 mi SE Weldon, Co. Rd. 300N bridge, county line	40.0*
20	EVBA-01	Un-named trib to Friends Creek [	MU	Piatt	3 mi NW Cisco, Co. Rd. 1800N bridge	72.0*
21	EV-04	Friends Creek	MU,W,S,H,ES,M	Macon	1.5 mi NNE Argentea, Cemetery Rd. bridge	177.30
22	EU-01	Big Creek	MU,W	Macon	1.5 mi NE Mt. Zion, Kruse Rd. bridge	61.30
23	EZP-01	Finley Creek	MU	Macon	2 mi S Mt. Zion, Hopewell Rd. bridge	54.11
24	ES-13	Stevens Creek	MU,W,S,H,ES,M	Macon	Decatur, Fairview Park	228.33
25	EQ-01	Mosquito Creek	MU,W,S,H,ES,M	Christian	2 mi NE Mt. Auburn, Co. Rd. 1550E bridge	201.38
Salt Creek drainage						
26	EI-07	Salt Creek	MU,W,S,H,BE,M	DeWitt	3.3 mi NE Farmer City, Weedman, Rt. 54 bridge	124.44
27	~ EIJ-02	North Fork Salt Creek	MU,W,S,H,ES,M	McLean	4.8 mi S LeRoy, Co. Rd. 00N	230.62
28	EII-01	Coon Creek	MU,W,S,H,ES,M	DeWitt	2 mi SW Clinton, Co. Rd. 500N bridge	49.16
29	EI-08	Salt Creek	MU	DeWitt	4 mi SW Clinton, Co. Rd. 400N bridge	857.45
30	EIH-01	Ten Mile Creek	MU,W,S,H,ES,M	DeWitt	3 mi NE Kenney, Co. Rd. 500E	113.36
31	EIGB-01	North Fork Lake Fork	MU,W	Logan	2.8 mi W Latham, Co. Rd. 2000E bridge	66.63
32	EIG-02	Lake Fork	MU,W	Logan	3.4 mi E Elkhart, Co. Rd. 700N	624.49
33	EIF-01	Deer Creek	MU,W,S,H,ES,M	Logan	4 mi ESE Lincoln, 1600th Ave.	129.62
34	EI-11	Salt Creek	MU,W	Logan	1.8 mi SW Lincoln, Railsplitter State Park	2151.95
35	EIE-16	Kickapoo Creek	MU	McLean	3.4 mi WSW Holder, off Cheneys Grove Rd.	45.13
36	EIE-17	Kickapoo Creek	MU	McLean	W edge Downs, Co. Rd. 2000E bridge	120.40
37	EIEI-02	Little Kickapoo Creek	MU,W,S,H,ES,M	McLean	7.5 mi S Bloomington, Co. Rd. 700N bridge	55.51
38	EIEI-03	Little Kickapoo Creek	MU,W,S,H,ES,M	McLean	3.5 mi N Heyworth, Co. Rd. 550N bridge	61.40
39[ab]	EIEI-01	Little Kickapoo Creek	MU,W	McLean	2.2 mi N Heyworth, Co. Rd. 425N bridge	73.95
40	EIE-03	Kickapoo Creek	MU,W,S,H,ES,M	McLean	2.1 mi W Heyworth, Hwy. 136	308.47
41	EIEE-01	Long Point Creek	MU,W,S,H,ES,M	DeWitt	3.9 mi SW Heyworth, Co. Rd. 700E	117.12
42b	EIE-10	Kickapoo Creek	MU,W,S,H,ES,M	Logan	2 mi NW Lincoln, Kickapoo Creek County Park	792.37
43	EI-17	Salt Creek	MU,W,S,H,BE,M	Logan	2 mi E Middletown, 1250th St.	3104.06
44	EID-16	Sugar Creek	MU,W,S,H,ES,M	McLean	4 mi SW Bloomington, Co. Rd. 1000N	108.02
45[a]	EIDC-01	Timber Creek	MU,W,S,H,ES,M	McLean	1.5 mi E Foosland, Co. Rd. 300E bridge	84.77
46[ab]	EIDE-01	Middle Fork Sugar Creek	MU,W,S,H,ES,M	McLean	9.5 mi E Hopedale, Co. Rd. 150E	169.17
47	EIDB-02	West Fork Sugar Creek	MU,W,S,H,ES,M	Tazewell	1 mi W Armington, Co. Rd. 100N	194.15
48	EID-04	Sugar Creek	MU,W	Logan	5.5 mi NNW Lincoln, 1050th Ave. gauging station	860.21
49b	EID-01	Sugar Creek	MU,W,S,H,BE,M	Logan	5.1 mi NW Kickapoo Creek, Rt. 10	928.80
50	EIDA-01	Prairie Creek	MU,W,S,H,ES,M	Mason	2.4 mi NE Sugar Creek, Co. Rd 800N	291.77
51	EI-02	Salt Creek	MU,W,S,BE	Mason	3.5 mi N Greenview, Hwy. 29	4630.19
Lower Sangamon and South Fork drainage						
52	EOH-01	Flat Branch	MU,W,S,H,ES,M	Christian	1.5 mi E Taylorville, Rt. 29	707.69
53	EOF-06	Bear Creek	MU,W,S,H,ES,M	Christian	3.5 Mi N Of Palmer	255.36
54	EO-15	South Fork Sangamon	MU,W,S,H,BE,M	Christian	3.5 mi WNW Taylorville, Co. Rd. 1500N bridge	1421.66
55	EOC-02	Horse Creek	MU,W,S,H,ES,M	Sangamon	0.5 MI S PAWNEE	139.15
56	EOCA-01	Brush Creek	MU,W,S,H,ES,M	Sangamon	Pulliam Rd Br, 4 Mi Nnw Of Pawnee	99.12
57	EOA-04	Sugar Creek	MU,W,S,H,ES,M	Sangamon	2 mi NE Auburn, Bab Rd. bridge	142.00
58	EOAA-01	Lick Creek	MU,W	Sangamon	2.1 mi E Loami, Reyhan Rd. bridge	239.14
59	E-26	Sangamon River	MU,W,BE	Sangamon	0.4 mi WSW Riverton, Old Rt. 36 bridge	6691.34
60	EM-01	Fancy Creek	MU,W,S,H,ES,M	Sangamon	1 mi E Sherman, Sherman Rd. bridge, Waldrop Park	96.69
61	EL-01	Spring Creek	MU,W,S,H,ES,M	Sangamon	2.7 mi WNW Springfield, Bruns Lane	271.39
62	EK-03	Richland Creek	MU,W,S,H,ES,M	Sangamon	1.5 mi SW Salisbury, Taylor Homestead Rd. bridge	100.41
63	EZZN-01	Rock Creek	MU,W,S,H,ES,M	Menard	4 Mi Sw Of Athens	46.66
64	EH-02	Crane Creek	MU,W,S,H,ES,M	Mason	1.8 mi W Easton, Co. Rd. 1200N bridge	76.66
65	EG-02	Clary Creek	MU,W	Menard	5 Mi S Oakford	89.86
66	EE-04	Panther Creek	MU,W,S,H,ES,M	Cass	3 Mi Sw Chandlerville At Ford	49.69
67	EEA-02	Cox Creek	MU,W,S,H,ES,M	Cass	2.5 Mi Se Of Chandlerville	68.74

Table 2. Mussel data for sites sampled during 2009-2011 surveys (Table 1) in the Upper Sangamon River (a.), Salt Creek (b.), Lower Sangamon River and South Fork drainages (c.), and summary of Sangamon River basin (d.). Numbers in columns are live individuals collected, "D" and "R" indicates that only dead or relict shells were collected. Shaded boxes indicate historical collections at the specific site location obtained from the INHS Mollusk Collection records. Extant species is live/dead shell and total species is live/dead/relict shell. Proportion of total is number of individuals of a species divided by total number of individuals at all sites. MCI scores and Resource Classification are based on values in Tables 3 and 4 (R=Restricted, L=Limited, M=Moderate, HV=Highly Valued, and U=Unique). NDA = no data available. Species in bold are federally or state-listed species, or species in Greatest Need of Conservation by IL DNR (2005).

a. Upper Sangamon drainage

Species	Upper Sangamon Drainage																									Proportion of live
	1	2	3	4	5	6	7	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Subfamily Anodontinae																											
Alasmidonta marginata						R																					-
Alasmidonta viridis	R		19	4	1	1						1															1.2%
Anodonta suborbiculata																											-
Anodontoides ferussacianus	R	R	21	2	5	3			D	2	1	1					D			1		11			D	R	2.3%
Arcidens confragosus							2	1							1												0.2%
Lasmigona complanata	3			2	R		7	5			2	1			3	1	R		D			6	D			R	1.4%
Lasmigona compressa	D		1	1	R	3				1	D	1							2	D		2			R		0.5%
Lasmigona costata							1	D																			-
Pyganodon grandis		1	1	D	R		1	1		1					2	D		1	8			1			R	R	0.8%
Strophitus undulatus	2		D	5	4	R	1	1		1	5	7							D						R		1.2%
Utterbackia imbecillis																			D				D				-
Subfamily Ambleminae																											-
Amblema plicata	26			1			7	4		R	11	9			3	R						81			R	R	6.8%
Elliptio dilatata							R	R							R										R		-
Fusconaia flava	329					11	32	2		D	2	6			4	1						34			R	R	20.2%
Pleurobema sintoxia	7		D				38	13							10	6											3.5%
Quadrula metanevra							1																				0.05%
Quadrula pustulosa	1					R	140	36							D	7						1					8.9%
Quadrula quadrula																										R	-
Tritogonia verrucosa							15	31							40	2						40				5	6.4%
Uniomerus tetralasmus				R	R						R						D	47	3	4	7	5	R	R	R	R	3.2%
Subfamily Lampsilinae																											
Lampsilis cardium	25		1	1	R	11	12	11		4	2	28			11	1	D		R			11			R		5.7%
Lampsilis siliquoidea	6		13	5		108	1			9	75	252			3	R						1				R	22.8%
Lampsilis teres																										R	-
Leptodea fragilis							15	2		1					9	4	R		D	D		38	D		D	D	3.3%
Ligumia subrostrata																		D				9	1		D		0.5%
Obliquaria reflexa															1												0.05%
Potamilus alatus	2			2			6	15			D	D			23	1			1			36					4.1%
Potamilus ohiensis																D			1			16	R				0.8%
Toxolasma parvum	R								20								D	1	3	2		71	D		R	R	4.6%
Truncilla donaciformis																											-
Truncilla truncata							12	8							4	6											1.4%
Venustaconcha ellipsiformis																									R		-
																											Totals
Individuals collected	401	1	56	23	10	137	291	130	20	19	98	306	0	0	116	29	0	49	18	7	7	363	1	0	0	5	2087
Live species collected	9	1	6	9	3	6	16	13	1	7	7	9	0	0	13	9	0	3	6	3	1	16	1	0	0	1	24
Extant species	9	1	8	10	3	6	16	14	2	8	9	10	0	0	14	11	4	4	10	5	1	16	5	0	3	2	25
Total species collected	12	2	8	11	8	9	17	15	2	9	10	10	0	0	15	13	6	4	11	5	1	16	7	1	13	12	30
Historical species richness	15	NDA	NDA	NDA	NDA	8	23	23	NDA	4	NDA	1	7	NDA	17	NDA	4	NDA	4	NDA	NDA	3	NDA	NDA	NDA	NDA	
Catch per unit effort (CPUE)	100	0.3	14	5.8	2.5	34	73	33	5	4.8	25	77	0	0	29	7.3	0	12	4.5	1.8	1.8	91	0.3	0	0	1.3	
Mussel Community Index (MCI)	14	4	14	15	8	12	18	16	10	10	9	14	0	0	12	11	0	8	11	10	6	14	9	0	0	6	
Resource Classification	HV	R	HV	HV	M	HV	U	U	M	M	M	HV	R	R	HV	M	R	M	M	M	L	HV	M	R	R	L	

b. Salt Creek drainage. * indicates 16-hour survey

Species	Salt Creek Drainage																												Prop. of live
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	39*	40	41	42*	43	44	45	45	46	46*	47	48*	49	50	51	
Subfamily Anodontinae																														
Alasmidonta marginata	1																		R				2	1		1				0.3%
Alasmidonta viridis		R															4	R			1	3								0.4%
Anodontoides ferussacianus	R	R			R	2	R	D		8	4	9	8	2	31		1	R		R	4	6	4	15	7			R		5.5%
Lasmigona complanata	5	R		3		1		2	D		7	2	2		8	R	1	1	D		11	19	3	9	R	1	D	8	3	4.7%
Lasmigona compressa	1									R		R	1	1	1						D	1								0.3%
Lasmigona costata																										R			R	-
Pyganodon grandis	R	2		9															D	R				1	1		R	R		0.7%
Strophitus undulatus	16	1	R	D	R	2		1		R	1	R	1	D	2	1		1	R		7	5	10	39	6		R		R	5.1%
Utterbackia imbecillis					R																							R		-
Subfamily Ambleminae																														
Amblema plicata	1	R		R	R	78		1	R		15		R	1	3		84	1	D	R		5	14	124	6	R	D	R	R	18.1%
Elliptio dilatata		R							R									R												-
Fusconaia flava	18	11		3		8	R		R		5		2	D	2		11	3	R	R	27	26	49	94	5	1	R	R	R	14.4%
Plethobasus cyphyus																			R											-
Pleurobema rubrum																			R											-
Pleurobema sintoxia	5			1					R									1	R			3	12	62	D		R		R	4.6%
Quadrula metanevra									R										R								R		R	-
Quadrula pustulosa	8	1		2					1									2	1				1	1	D	1			R	1.0%
Quadrula quadrula				8							1							3	R					3	D	1	D		R	0.9%
Tritogonia verrucosa				6					D							1		2								3	R		R	0.7%
Uniomerus tetralasmus		R								1	R	1	R		2		D					R			R				0.2%
Subfamily Lampsilinae																														
Actinonaias ligamentina									R										R										R	-
Lampsilis cardium	15	6		6	2	8		2	R	R	16	9	4	9	25	7	D	13	16		24	53	20	72	5	36	4	1	8	19.7%
Lampsilis siliquoidea	4	2		1	R	R			R	6	25	8	16	23	78	1	5	R		R	19	103	1	4			R		R	16.1%
Lampsilis teres			D	R	R	R	R		R		D			R	1	D		R	4		8	28		1	1	R	R	1	4	2.6%
Leptodea fragilis		12		2	R				1		1					2		R	1						R	5	D	D	6	1.6%
Ligumia recta																											R		R	-
Obliquaria reflexa				10					1																					0.6%
Potamilus alatus	3			1		D			D	2	10								1										1	1.0%
Potamilus ohiensis				2					D										3										11	0.9%
Toxolasma parvum					R		R			1	1		R	1			R				R				R					0.2%
Truncilla donaciformis				10															R										R	0.5%
Truncilla truncata				D																							R			-
Venustaconcha ellipsiformis	R			R												R			R											-
																														Totals
Individuals collected	77	35	0	64	2	99	0	6	3	18	86	29	34	37	153	12	106	27	26	0	101	252	116	426	31	49	4	10	33	1836
Live species collected	11	7	0	14	1	6	0	4	3	5	11	5	7	6	10	5	6	9	6	0	8	11	10	13	7	8	1	3	6	23
Extant species	11	7	1	16	1	7	0	5	7	5	12	5	7	8	10	6	8	9	9	0	9	11	10	13	10	8	5	4	6	24
Total species collected	14	13	2	19	9	9	4	5	16	8	13	7	10	9	10	8	9	15	20	5	10	12	10	13	14	11	15	9	19	33
Historical species richness	14	NDA	NDA	19	NDA	NDA	2	NDA	15	5	11	8	6	9	9	12	NDA	NDA	10	3	14	14	9	9	NDA	NDA	NDA	NDA	12	
Catch per unit effort (CPUE)	19	8.8	0	16	0.5	25	0	1.5	0.8	4.5	22	7.3	8.5	9.3	38	3	27	6.8	6.5	0	25	63	29	107	7.8	3.1	1	2.5	8.3	
Mussel Community Index	12	8	0	13	4	9	0	7	6	8	10	7	8	8	9	7	11	8	10	0	13	16	13	14	11	8	5	7	7	
Resource Classification	HV	M	R	HV	R	M	R	L	L	M	M	L	M	M	M	L	M	M	M	R	HV	U	HV	HV	M	M	L	L	L	

c. Lower Sangamon and South Fork drainage

Species	Lower Sangamon and South Fork Drainage												Proportion of live
	52	54	56	57	58	59	60	61	62	64	65	67	
Subfamily Anodontinae													
Arcidens confragosus		6											3.5%
Lasmigona complanata	2	11				D		4		4			12.2%
Lasmigona compressa													-
Pyganodon grandis	1	4		52	R	D		1					33.7%
Utterbackia imbecillis				D				R					-
Subfamily Ambleminae													
Amblema plicata	D	3											1.7%
Fusconaia flava		2											1.2%
Quadrula pustulosa	R	D				5							2.9%
Quadrula quadrula	4	D				D							2.3%
Tritogonia verrucosa	6	2						1					5.2%
Uniomerus tetralasmus							R	D	R				-
Subfamily Lampsilinae													
Lampsilis siliquoidea												R	-
Leptodea fragilis	D	2				27		2		1			18.6%
Ligumia subrostrata								2					1.2%
Obliquaria reflexa	D	1											0.6%
Potamilus ohiensis		1				23							14.0%
Toxolasma parvum									D				-
Truncilla donaciformis						1							0.6%
Truncilla truncata	D	4				D							2.3%
													Totals
Individuals collected	13	36	0	52	0	56	0	10	0	5	0	0	172
Live species collected	4	10	0	1	0	4	0	5	0	2	0	0	14
Extant species	8	12	0	2	0	8	0	6	1	2	0	0	17
Total species collected	9	12	0	2	1	8	1	7	2	2	0	1	18
Historical species richness	7	11	2	2	NDA	NDA	NDA	NDA	1	NDA	1	3	
Catch per unit effort (CPUE)	3.25	9	0	13	0	14	0	2.5	0	1.25	0	0	
Mussel Community Index (MCI)	8	11	0	11	0	13	0	9	0	6	0	0	
Resource Classification	M	M	R	M	R	HV	R	M	R	L	R	R	

d. Summary of sites sampled in the Sangamon basin during 2009-2011 (67 sites, 324 total hours) and summary of species collections by Schanzle and Cummings in 1991 (57 sites, 228 total hours). ***Simpsonaias ambigua*, *Cyclonaias tuberculata*, *Quadrula nodulata*, *Quadrula fragosa*, *Ellipsaria lineolata*, *Epioblasma triquetra*, *Lampsilis higginsii*, *Leptodea leptodon*, *Obovaria olivaria*, *Villosa iris* and *V. lienosa* are included in historical total but not represented in the table.

						Schanzle and Cummings, 1991	
Species	**Total individuals**	**No. sites live**	**No. sites extant**	**No. sites relict**	**Proportion of total live**	**Total individuals**	**Proportion of total live**
Subfamily Anodontinae							
Alasmidonta marginata	5	4	4	6	0.12%	9	0.43%
Alasmidonta viridis	35	9	9	12	0.81%	5	0.24%
Anodonta suborbiculata	0	0	0	0	-	4	0.19%
Anodontoides ferussacianus	148	22	27	37	3.44%	50	2.40%
Arcidens confragosus	10	4	4	4	0.23%	7	0.34%
Lasmigona complanata	138	31	37	43	3.20%	213	10.23%
Lasmigona compressa	16	12	16	21	0.37%	5	0.24%
Lasmigona costata	1	1	2	4	0.02%	2	0.10%
Pyganodon grandis	88	17	21	29	2.04%	178	8.55%
Strophitus undulatus	120	23	27	36	2.79%	57	2.74%
Utterbackia imbecillis	0	0	3	6	-	8	0.38%
Subfamily Ambleminae							
Amblema plicata	491	22	25	38	11.40%	166	7.97%
Elliptio dilatata	0	0	0	7	-	1	0.05%
Fusconaia flava	861	26	28	37	19.99%	110	5.28%
Megalonaias nervosa	0	0	0	0	0.00%	11	0.53%
Plethobasus cyphyus	0	0	0	1	-	0	-
Pleurobema rubrum	0	0	0	1	-	0	-
Pleurobema sintoxia	170	12	14	18	3.95%	67	3.22%
Quadrula metanevra	1	1	1	5	0.02%	1	0.05%
Quadrula pustulosa	208	15	18	21	4.83%	158	7.59%
Quadrula quadrula	20	6	10	13	0.46%	60	2.88%
Tritogonia verrucosa	154	13	14	16	3.58%	34	1.63%
Uniomerus tetralasmus	70	8	11	25	1.63%	10	0.48%
Subfamily Lampsilinae							
Actinonaias ligamentina	0	0	0	3	-	0	-
Lampsilis cardium	489	36	38	43	11.35%	247	11.86%
Lampsilis siliquoidea	773	26	26	36	17.95%	39	1.87%
Lampsilis teres	48	8	11	21	1.11%	160	7.68%
Leptodea fragilis	131	18	27	31	3.04%	188	9.03%
Ligumia recta	0	0	0	2	-	0	-
Ligumia subrostrata	12	3	5	5	0.28%	2	0.10%
Obliquaria reflexa	13	4	5	5	0.30%	14	0.67%
Potamilus alatus	104	14	19	19	2.41%	48	2.30%
Potamilus ohiensis	57	7	9	10	1.32%	132	6.34%
Toxolasma parvum	100	8	12	21	2.32%	1	0.05%
Truncilla donaciformis	11	2	2	4	0.26%	33	1.58%
Truncilla truncata	34	5	8	9	0.79%	60	2.88%
Venustaconcha ellipsiformis	0	0	0	5	-	3	0.14%

	Totals		
Individuals collected	4308	2083	
Live species collected	28	33	
Extant species	29	-	
Total species collected	35	37	
Historical species	48**		

Table 3. Mussel Community Index (MCI) parameters and scores.

Extant species in sample	Species Richness		Catch per Unit Effort (CPUE)	Abundance (AB) Factor
0	1		0	0
1-3	2		1-10	2
4-6	3		>10-30	3
7-9	4		>30-60	4
10+	5		>60	5
% live species with recent recruitment	Reproduction Factor		# of Intolerant species	Intolerant species Factor
0	1		0	1
1-30	3		1	3
>30-50	4		2+	5
>50	5			

Table 4. Freshwater mussel resource categories based on species richness, abundance, and population structure. MCI = Mussel Community Index Score

Unique Resource MCI ≥ 16	Very high species richness (10 + species) &/or abundance (CPUE > 80); intolerant species typically present; recruitment noted for most species
Highly Valued Resource MCI = 12- 15	High species richness (7-9 species) &/or abundance (CPUE 51-80); intolerant species likely present; recruitment noted for several species
Moderate Resource MCI = 8 - 11	Moderate species richness (4-6 species) &/or abundance (CPUE 11-50) typical for stream of given location and order; intolerant species likely not present; recruitment noted for a few species
Limited Resource MCI = 5 - 7	Low species richness (1-3 species) &/or abundance (CPUE 1-10); lack of intolerant species; no evidence of recent recruitment (all individuals old or large for the species)
Restricted Resource MCI = 0 - 4	No live mussels present; only weathered dead, sub-fossil, or no shell material found

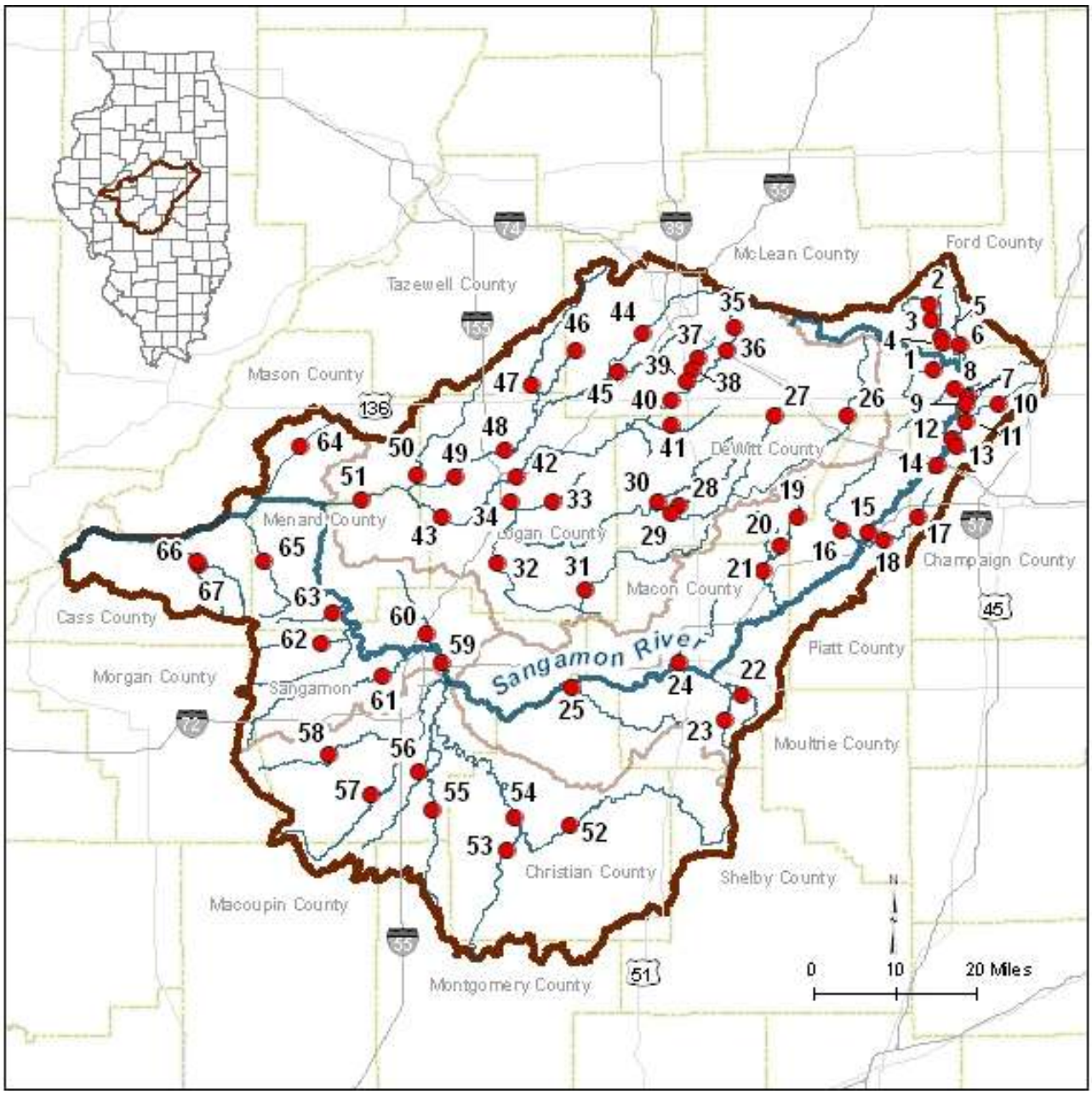

Figure 1. Sites sampled in the Sangamon River basin in 2009 - 2011. Site codes referenced in Table 1.

Figure 2a. Upper Sangamon River (29 sites)

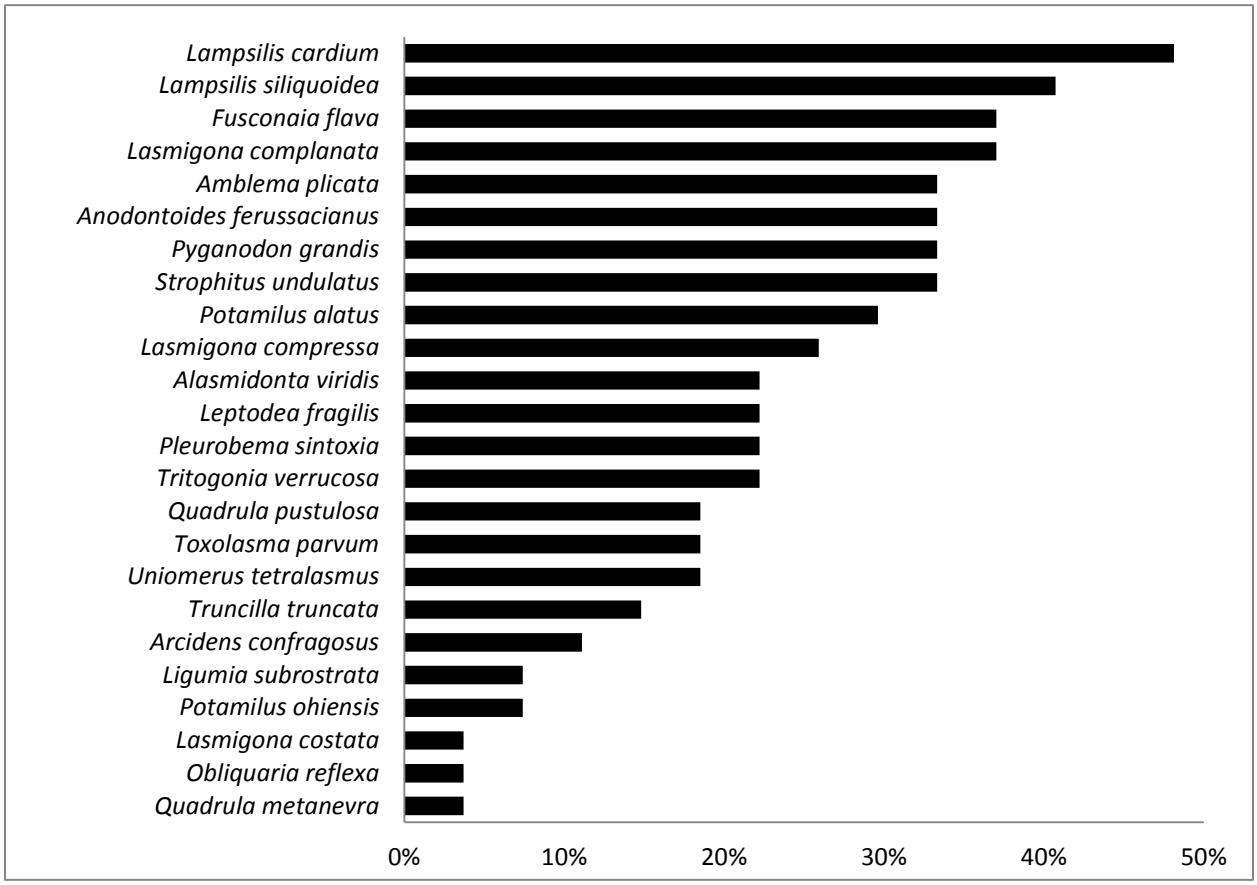

Figure 2b. Salt Creek (26 sites)

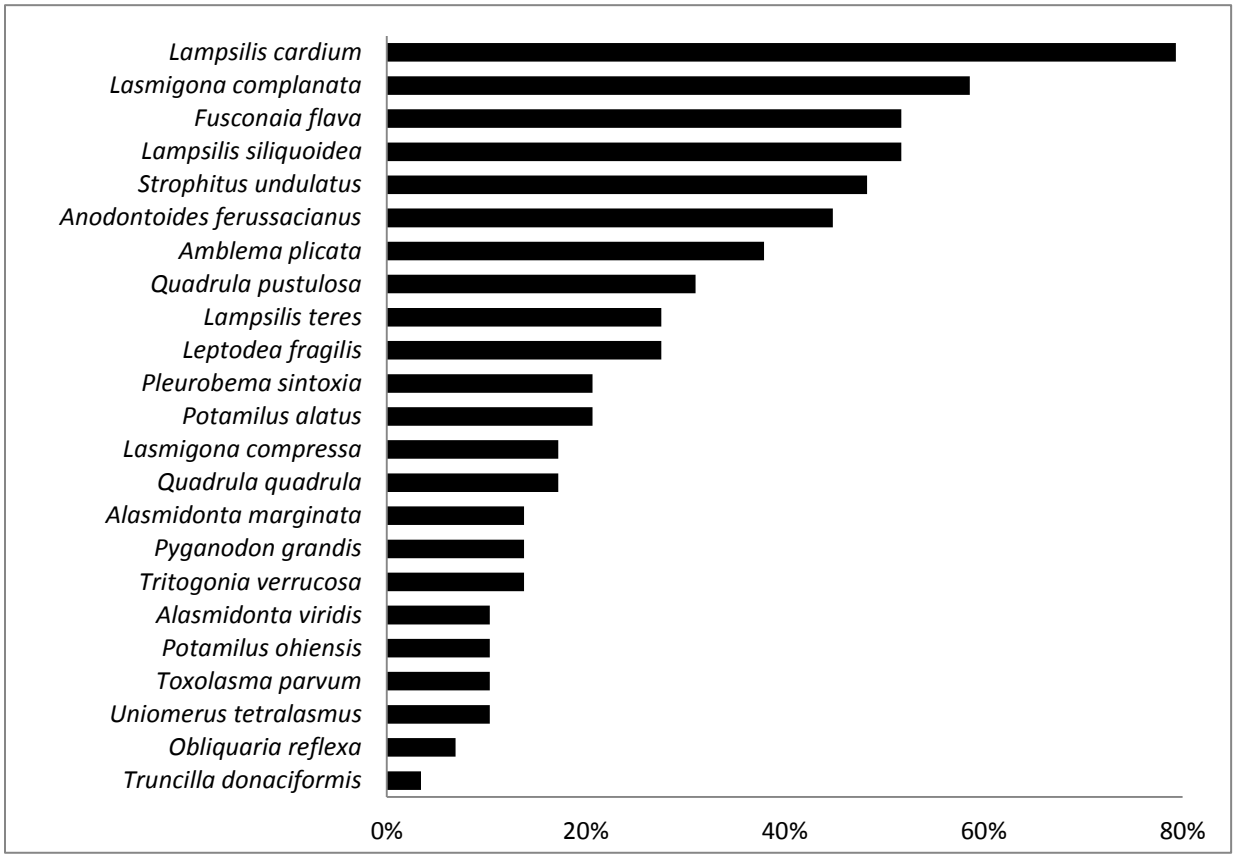

Figure 2c. Lower Sangamon River (16 sites)

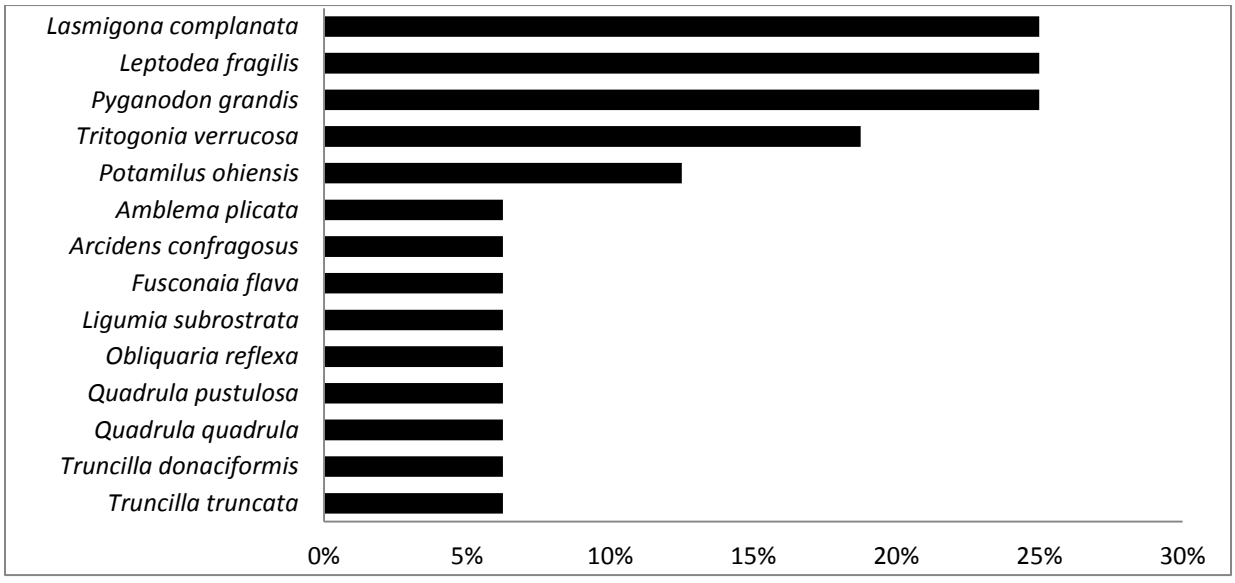

Figure 2. Number of sites where a species was collected live compared to the number of sites sampled in the Upper Sangamon River (a. 29 sites), Salt Creek (b. 26 sites), and the Lower Sangamon River (c. 16 sites).

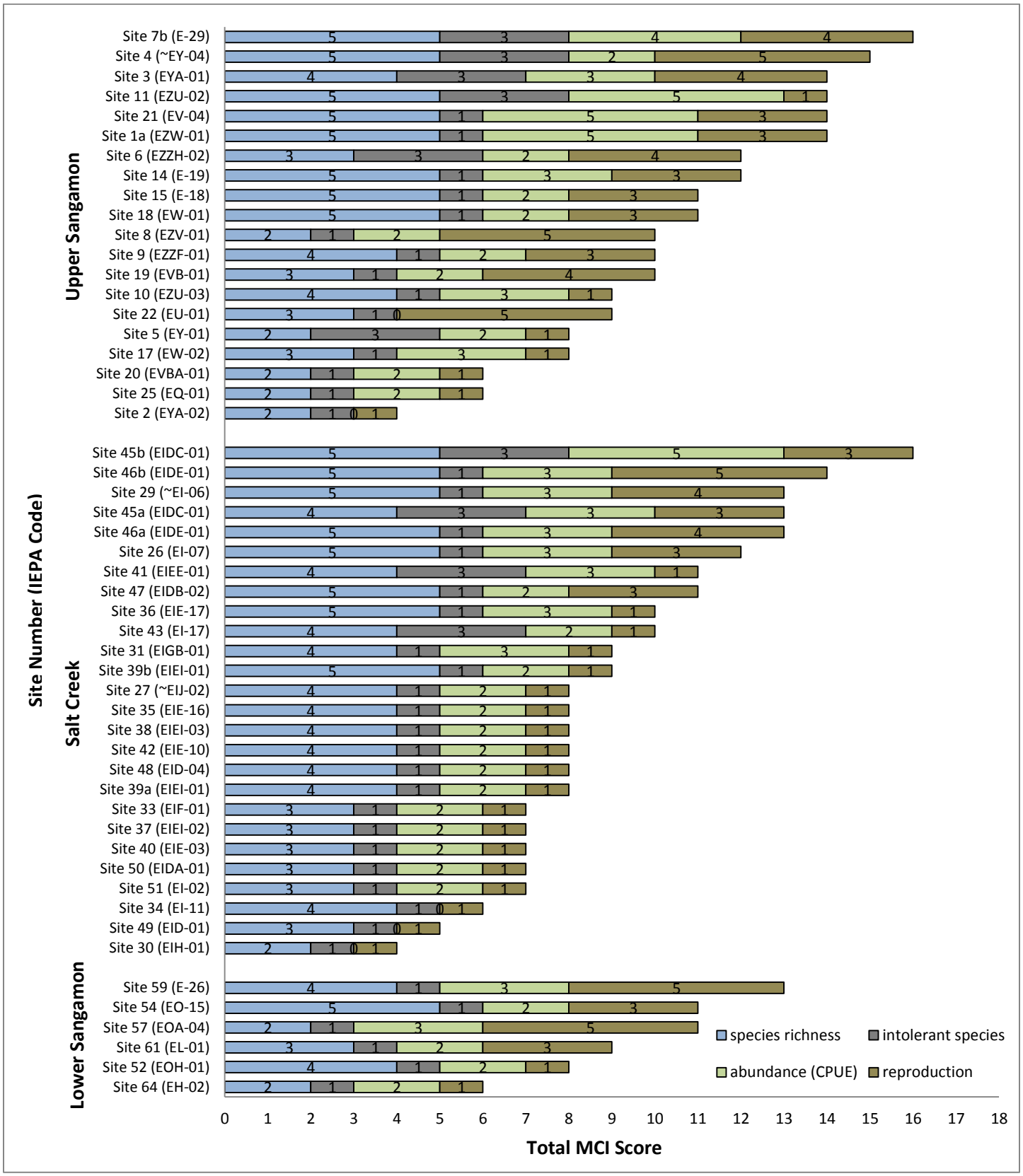

Figure 3. Comparison of Mussel Community Index (MCI) and MCI component scores for Sangamon River basin sites based factor values from Table 3.

Figure 4. Bank erosion and sediment deposition in Lower Sangamon River drainage (site 59).

Figure 5. Rocky substrate and intact riparian zone of Kickapoo Creek in Salt Creek drainage (site 36).

Figure 6. Destabilized banks and channelization of lower Salt Creek (site 43).

Figure 7. Depth issues in lower Sangamon River and South Fork drainage (site 54)

Appendix 1. Scientific and common names of species. Status (in 2012): SGNC-Illinois' species in greatest need of conservation, ST-state threatened, SE-state endangered, FE-federally endangered, X-extirpated in Illinois.

Scientific name	Common name	Status
Subfamily Anodontinae		
Alasmidonta marginata	elktoe	
Alasmidonta viridis	slippershell	ST
Anodonta suborbiculata	flat floater	
Anodontoides ferussacianus	cylindrical papershell	
Arcidens confragosus	rock pocketbook	SGNC
Lasmigona complanata	white heelsplitter	
Lasmigona compressa	creek heelsplitter	SGNC
Lasmigona costata	flutedshell	SGNC
Pyganodon grandis	giant floater	
Simpsonaias ambigua	salamander mussel	SE
Strophitus undulatus	creeper	
Utterbackia imbecillis	paper pondshell	
Subfamily Ambleminae		
Amblema plicata	threeridge	
Cyclonaias tuberculata	purple wartyback	ST
Elliptio dilatata	spike	ST
Fusconaia ebena	ebonyshell	ST
Fusconaia flava	Wabash pigtoe	
Megalonaias nervosa	washboard	
Plethobasus cyphyus	sheepnose	FE
Pleurobema rubrum	pyramid pigtoe	SE
Pleurobema sintoxia	round pigtoe	
Quadrula fragosa	winged mapleleaf	FE, X
Quadrula metanevra	monkeyface	SGNC
Quadrula nodulata	wartyback	
Quadrula pustulosa	pimpleback	
Quadrula quadrula	mapleleaf	
Tritogonia verrucosa	pistolgrip	
Uniomerus tetralasmus	pondhorn	
Subfamily Lampsilinae		
Actinonaias ligamentina	mucket	
Ellipsaria lineolata	butterfly	ST
Epioblasma triquetra	snuffbox	SE
Lampsilis cardium	plain pocketbook	
Lampsilis higginsii	Higgins eye	FE
Lampsilis siliquoidea	fatmucket	
Lampsilis teres	yellow sandshell	
Leptodea fragilis	fragile papershell	
Leptodea leptodon	scaleshell	FE, X
Ligumia recta	black sandshell	ST
Obliquaria reflexa	threehorn wartyback	
Obovaria olivaria	hickorynut	
Potamilus alatus	pink heelsplitter	
Potamilus ohiensis	pink papershell	
Toxolasma parvum	lilliput	
Truncilla donaciformis	fawnsfoot	
Truncilla truncata	deertoe	
Venustaconcha ellipsiformis	ellipse	SGNC
Villosa iris	rainbow	SE
Villosa lienosa	little spectaclecase	SE